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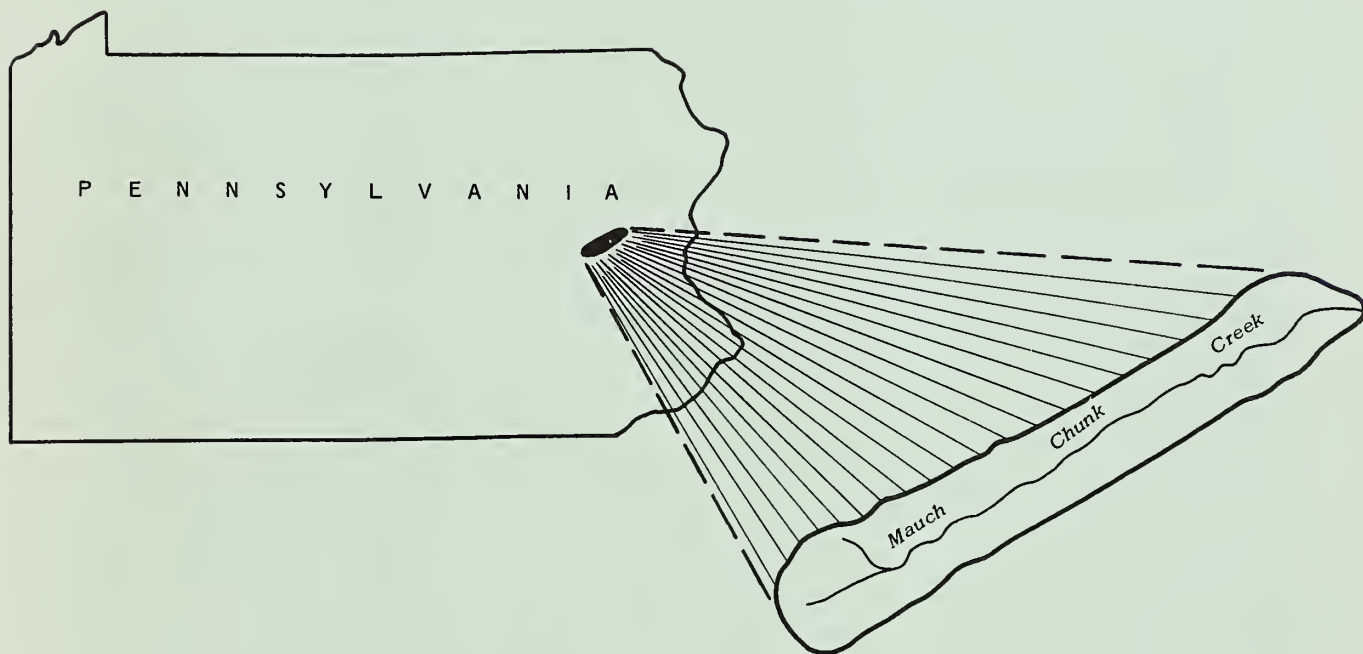
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WORK PLAN

MAUCH CHUNK CREEK WATERSHED



CARBON AND SCHUYLKILL COUNTIES

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APRIL 1965

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WATERSHED WORK PLAN

MAUCH CHUNK CREEK WATERSHED

Carbon and Schuylkill Counties, Pennsylvania



Prepared Under the Authority of the Watershed
Protection and Flood Prevention Act (Public
Law 566, 83d Congress, 68 Stat. 666), as amended.

Prepared by: Carbon County Soil & Water Conservation District
Schuylkill County Soil & Water Conservation District
Jim Thorpe Borough Council
Summit Hill Borough Council
Carbon County Commissioners
Pennsylvania Fish Commission
Carbon County Recreation Authority

With assistance by:

U. S. Department of Agriculture, Soil Conservation Service
U. S. Department of Agriculture, Forest Service

April 1965



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WATERSHED WORK PLAN

MAUCH CHUNK CREEK WATERSHED Carbon and Schuylkill Counties, Pennsylvania

April 1965

SUMMARY OF PLAN

The Mauch Chunk Creek watershed drains 5,790 acres (9.0 sq. mi.) of which 95 percent is in Carbon County with the remaining area in Schuylkill County. The downstream boundary terminates at its confluence with the Lehigh River.

The sponsoring local organizations are the Carbon County Soil and Water Conservation District, Schuylkill County Soil and Water Conservation District, Jim Thorpe Borough Council, Summit Hill Borough Council, Carbon County Commissioners, Carbon County Recreation Authority, and the Pennsylvania Fish Commission.

The primary problem in the watershed is floodwater damage to the Borough of Jim Thorpe. Other problems include sedimentation damages and a need for additional municipal water supply and water oriented recreation facilities.

The flood of August 24, 1933, was the most severe in recent history. A recurrence of a similar flood would result in damages of \$469,000.

A comprehensive plan for development of the water resources has been prepared by the sponsors with the assistance of the U. S. Soil Conservation Service, and the U. S. Forest Service. Other State and Federal agencies were consulted including the U. S. Agricultural Stabilization and Conservation Service, U. S. Fish and Wildlife Service, Pennsylvania Game Commission and the Pennsylvania Department of Forests and Waters.

This plan includes conservation land treatment as well as one multiple purpose structure providing storage for flood water, municipal water supply and recreation development.

The work plan proposes installing in a four-year period a project for protection and development of the watershed at a total estimated installation cost of \$1,217,907. The share of this cost to be borne by Public Law 566 funds is \$444,067 with the remaining \$773,840 borne by local and other funds. The sponsors are also responsible for operation and maintenance costs.

Land Treatment Measures

The cost for land treatment is estimated to be \$116,060 of which \$106,610 will be borne by local and other funds. Public Law 566 funds

in the amount of \$9,450 will be used for accelerating technical assistance and consist of \$5,350 for use of the Soil Conservation Service and \$4,100 for use of the Forest Service.

Structural Measures

Structure PA-462 is a multiple purpose flood prevention, municipal water supply and recreation development structure. It controls 5.95 sq. mi. of drainage area and provides storage for 1,094 acre feet of floodwater, 61 acre feet for sediment, 375 acre feet for water supply and 3,794 acre feet for recreation development. The permanent pool for recreation development will have a surface acreage of 330 acres.

The installation cost of the structural program is estimated to be \$1,101,847. Of this amount Public Law 566 funds will bear \$434,617 and local interests will provide \$667,230.

Damages and Benefits

The estimated average annual direct and indirect floodwater damage without the project is \$8,846.

The average annual benefit accruing to the structural measures is \$229,125. The benefits accruing to structural measures include \$8,425 for floodwater damage reduction, \$7,000 for water supply, \$180,000 for recreation, \$28,400 for secondary benefits and \$5,300 for redevelopment benefits.

The ratio of the average annual structural benefits (\$229,125) to the estimated average annual costs (\$55,240) is 4.1 to 1.0.

The total benefits of land treatment measures were not evaluated in monetary terms.

Provisions for Financing Construction

Structure PA-462

The Pennsylvania Fish Commission, the Carbon County Recreation Authority and the Carbon County Commissioners will be responsible for all land rights' costs. The Pennsylvania Fish Commission will acquire sufficient land for the lake and surrounding area to permit appropriate development and full public use of the facilities. This acreage of land is estimated to be 700 acres. The Carbon County Recreation Authority and the Carbon County Commissioners will acquire an additional 900 acres of land.

The Carbon County Recreation Authority and the Carbon County Commissioners will be responsible for the local share of the construction cost for recreation development, the associated recreation facilities and the engineering service costs for the recreation facilities. The Pennsylvania Department of Forests and Waters and/or the Water and Power Resources Board of the

Department will cooperate with the Carbon County Commissioners in sharing a portion of the local costs. It is estimated that the Commonwealth will provide approximately \$100,000 as its share of the construction costs of Structure PA-462. The Boroughs of Jim Thorpe and Summit Hill will provide \$20,000 each to the Carbon County Commissioners as part of the cost for recreation construction. The remaining local cost for recreation construction, associated recreation facilities and engineering services for the recreation facilities will be the responsibility of the Carbon County Commissioners.

The Borough of Jim Thorpe will be responsible for construction and engineering service costs of the municipal water supply features of PA-462.

The Carbon County Commissioners will be responsible for administration of contracts for construction of PA-462 and the associated recreation facilities.

The cost of land rights is \$355,400, cost of administering the contracts is \$6,000 and the local share of the construction and engineering service costs is \$305,830.

Operation and Maintenance

Land treatment measures will be maintained by the landowners and operators under agreement with the Carbon and Schuylkill County Soil and Water Conservation Districts.

The Carbon County Recreation Authority and the Carbon County Commissioners will be responsible for operation and maintenance of PA-462 and the associated recreation facilities at an estimated annual cost of \$19,145.

DESCRIPTION OF THE WATERSHED

Physical Data

The Mauch Chunk Creek watershed is located in Carbon and Schuylkill Counties in northeastern Pennsylvania. The watershed area is 5,790 acres (9.0 sq. mi.) of which 5,528 acres is in Carbon County and 262 acres is in Schuylkill County. The downstream boundary of the watershed is at the confluence of Mauch Chunk Creek with the Lehigh River.

The topography in the watershed is generally steep with elevations ranging from 540 feet at Jim Thorpe to 1,660 feet at the headwaters. The farming enterprise is limited to a small number of part time farmers in the upper limits of the watershed. The middle portion is in forest cover. The Borough of Jim Thorpe is located in the lower portion of the watershed while the Borough of Summit Hill is located along the western edge.

Geology

The Mauch Chunk Creek watershed lies wholly within the ridge and valley physiographic province. The valley which forms the watershed is comprised of a bank of red shale intermediate between two hard, resistant sandstone and shale formations. These strata strike toward the northeast and dip northward resulting from their position on the southern limb of a syncline. Glacial deposits of the Illinoian glacial stage mantle the valley floors to considerable depth. Debris from the steep mountain slopes overlaps underlying rocks along the valley sides.

Soils

The soils of the watershed are generally deep, stony, and are variable in natural drainage. They vary in derivation from soils formed from residual material of underlying sandstone, shales and conglomerates to soils formed from glacial and colluvial rubble. They occur on a variety of slopes from steep to moderate. Bottom land soils are poorly drained silt and clay loams and are frequently underlain by sand and gravel.

Principal soil series include:

<u>FLOOD PLAIN</u>			
<u>Soil Series</u>	<u>Depth</u>	<u>Drainage</u>	<u>Parent Material</u>
Holly	Deep	Poorly drained	Alluvial material
Papakating	Deep	Very poorly drained	Alluvial material
<u>UPLAND</u>			
Buchanan	Deep	Moderately well drained	Colluvium from gray and red sandstone and shales
Dekalb	Shallow to moderately deep	Well drained	Acid gray sandstone
Fleetwood	Deep	Well drained	Quartzite and sandstone
Hazleton	Deep	Well drained	Glacial materials from acid sandstone
Klinesville	Shallow	Well drained	Red siltstone, sandstone and shale
Laidig	Deep	Well drained	Colluvium from gray sandstone and conglomerate

Water

Mauch Chunk Creek has its headwaters about two miles southwest of Summit Hill Borough and flows in a northeasterly direction to its confluence with the Lehigh River of Jim Thorpe. There are no major tributaries. The watershed is approximately 8.5 miles long with an average width of 1.3 miles.

The stream gradient varies from less than one percent in the upper limits to three percent in the Borough of Jim Thorpe.

Climatological

Precipitation in the watershed averages 47 inches annually with about 24 inches falling in the growing season. The climate of the watershed is moderate with an average temperature of 49°F.

The frost-free growing season ranges from 140 to 170 days.

Land Use and Cover Conditions

Land use is estimated to be 4 percent cropland, 1 percent grassland, 82 percent woodland, 5 percent idle and 8 percent in streams, roads and towns.

The cropland and grassland acreage of 290 acres is utilized for general farm crops and forage crops.

Inactive strip mining operations cover 110 acres on the northwestern edge of the watershed in the vicinity of Summit Hill.

Approximately 82 percent (4,735 acres) is in forest cover. It has been determined that 36 percent of the forest land is in very poor hydrologic condition, 60 percent in poor, and 4 percent in fair hydrologic condition. Fire, overcutting and damaging logging in the past have contributed to the poor hydrologic condition of the forest land. With protection and management, most of the forest land should be in fair condition within the evaluation period.

Economic Data

Population of the watershed is approximately 4,400. The borough of Jim Thorpe contains 62 percent of the total population with 30 percent located in Summit Hill and the remaining 8 percent being rural residents.

Industrial activities in the area have been centered on coal mining and the railroad industry. Due to the decline of both, the garment and metal industries are the main source of employment. Industries in Jim Thorpe include textile, garment, and leather manufacturing. Many residents of Jim Thorpe commute to areas outside of the watershed for employment.

Carbon County has been authorized for assistance under Section 5A of the Area Redevelopment Act.

Agriculture is of minor importance in the watershed. Farming is restricted to twelve part-time farming operations with production centered on general farm crops. Future land use estimates indicate that within a few years after the watershed program is established, all cropland will be converted to other uses.

The Carbon and Schuylkill County Soil and Water Conservation Districts have been in operation for eighteen and ten years respectively. In the watershed area, twelve landowners have developed conservation plans on 2,100 acres of land. Table 1A indicates the type and amount of land treatment measures installed in the watershed.

A comprehensive analysis of the impact of the reservoir construction on the watershed and area economy has been made by the sponsors. The Area Redevelopment Administration of the U. S. Department of Commerce advanced a grant for undertaking this study. The primary purpose of the study was to explore the feasibility of a recreation facility complex in the watershed, to determine the potential market for proposed recreation activities, and to indicate the employment opportunities and the effect on the local economy after the proposed program is established. The study indicated that one of the most important benefits to be derived from the development of the recreation complex would be the creation of employment opportunities to absorb persons who for many years have been unemployed. It was estimated that the number of jobs which could be created with the full development of the recreation potential would be approximately 250.

The land in the watershed is privately-owned with the exception of a small portion under the ownership of the Summit Hill Water Authority. The forest areas are owned principally by recreation and industrial interests and residents of the watershed.

Second growth northern hardwood and mixed oak stands occupy most of the forest land. There are several small areas of white pine-hemlock and coniferous plantations. Most of the timber is immature. About 16 percent of the forest stands is of sawtimber size, 56 percent in pole size stands, and 28 percent in stands of seedling and sapling size.

Adequate forest fire protection is provided by the Pennsylvania Department of Forests and Waters, in cooperation with the U. S. Forest Service through the Clarke-McNary Cooperative Fire Control Program. Given protection, care and management, the forest stands are expected to contribute to the future recreational development and general economy of the watershed.

The wildlife resources of the area attract hunters of small game and deer. Small game animals include rabbits, squirrel, and ruffed grouse. Mauch Chunk Creek supports a marginal trout fishery.

The watershed and surrounding area has a good system of highways making the area readily accessible. Routes 209 and 45 pass through the lower part of the watershed and State Route 13033 traverses the watershed. The Pennsylvania Turnpike, Northeast Extension, passes within a few miles of Jim Thorpe. The Mahoning Valley interchange, seven miles from the watershed, exits about 700,000 passenger vehicles annually. The Keystone Shortway, Interstate Route 80, which is under construction will pass within 15 miles of the watershed.

The Lehigh Valley Railroad located on the east side of the Lehigh River and the Central Railroad of New Jersey located on the west bank of the Lehigh River service the watershed.

WATERSHED PROBLEMS

Floodwater Damage

Mauch Chunk Creek enters an underground channel near the western edge of Jim Thorpe Borough. From this point it flows underneath Broadway Avenue, the main thoroughfare of Jim Thorpe, for 4,500 feet until it joins the Lehigh River. Flood peaks exceeding the capacity of this conduit cause severe damage to the many homes and businesses along Broadway Avenue.

Documented historical records indicate that severe damage occurred from Mauch Chunk floods in June 1841, September 1859, August 1862, October 1869, August 1901, June 1928, and August 1933. A minor flood causing relatively little damage occurred in May 1942. The infrequency of major floods since 1933 is the result of a channel improvement project completed in 1937. The conduit under Broadway Avenue will now handle a 30-year flooding event.

A repetition of the August 24, 1933 flood, a 100-year frequency event, would cause \$469,000 damages. It was produced by a 4.31 inch rainstorm of twelve hours duration, following a 2.7 inch rainfall of the previous day.

A flood of this magnitude would damage 204 residences, 37 businesses, 4 industries, and cause some \$38,000 in street damage. Average annual flood damages are \$8,846.

Since a high percentage of the property damage would be commercial, indirect damages are estimated to be 20 percent of the direct damages. These damages would include loss of wages to employees, increased costs due to rerouting of traffic and interruption of public utility services.

Erosion Damage

Erosion in the watershed is not critical although sheet erosion in upland areas is noticeable in several locations. The contribution of the mine spoil areas to the total sediment picture is minor. Some of the spoil piles are partially vegetated.

Streambank erosion occurs to a minor extent in the watershed. This erosion is generally taking place on low value land so the extent of its damage was not appraised. Streambank erosion was considered as a sediment source in the design of the proposed reservoirs.

Sediment Damage

Sediment damages in the watershed are slight. Flood plains are narrow and poorly drained. There is some evidence of deposition of infertile materials on flood plain lands, but due to the low intensity of use, little or no damage results.

Total annual sediment production which is predominantly derived from sheet erosion is 0.6 acre feet per square mile. Average annual sediment yield at the structure is 0.5 acre feet.

Sediment from various sources produces damages associated with floodwater damage but because of the difficulty in separating them, they were evaluated as part of the total floodwater damage.

Problems Relating to Water Management

Water Supply

Residents in the upper limits of the watershed obtain their water from the Summit Hill Water Authority while residents in Jim Thorpe are supplied through the Jim Thorpe Water Authority. The Jim Thorpe Water Authority purchased two private water companies in 1962 at a cost of \$435,234.

Sources of water supply include wells and Mauch Chunk Creek. The low flow of Mauch Chunk Creek during drought periods together with the need for an expanded water supply to meet future demands made it necessary to consider an additional source of supply. The consulting firm retained by the Jim Thorpe Water Authority indicated that a reservoir on Mauch Chunk Creek would best serve Jim Thorpe's needs.

Recreation

The development of water oriented recreation facilities in this area is limited because most streams are heavily polluted by mine wastes. The recreation potential study developed by the sponsors with the aid of a grant from the Area Redevelopment Administration, indicated that water oriented facilities in the watershed were needed to meet the demand for day use recreation seekers and overnight visitors. The annual day use demand for the Mauch Chunk Creek area was estimated to be 844,000 while an additional 5,600 overnight visitors could be expected annually if facilities to meet their needs were available.

Water Quality

Sewerage systems, including treatment facilities, are under construction or being planned in both Jim Thorpe and Summit Hill.

PROJECTS OF OTHER AGENCIES

A channel improvement project was completed following the flood of 1933. No other water resource development measures which will affect the proposed program have been built or are planned within the watershed. The works of improvement set forth in this plan will constitute needed and harmonious elements in the development of the Delaware River Basin.

BASIS FOR PROJECT FORMULATION

The sponsors desired protection in Jim Thorpe from a one hundred-year frequency storm. Protection of residential and commercial areas on the flood plain was of major concern.

Channel enlargement was considered but would be prohibitive in cost because of bridges, utilities, buildings and other encroachments.

The objectives for land treatment and proper land use were also of prime consideration to the sponsors. The Soil and Water Conservation Districts' objectives have been and will continue to be desirable land use adjustments and use of land resources to effect an improvement of the economy of the watershed with emphasis being put on the orderly transition in land use of the areas going out of agricultural production and the encouragement of the establishment of both private and public recreation developments.

The Soil and Water Conservation District Directors, county planning commissions and others have indicated that they will work closely with the landowners in the watershed to bring about conservation treatment and orderly development of the recreation lands throughout the watershed as quickly as resources permit. The land treatment portion of the work plan reflects these objectives.

The need for additional municipal water supply and water oriented recreation facilities resulted in these features being added in the work plan.

The proposed plan provides the desired protection at the lowest installation cost of all alternatives studied.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Land treatment measures will be installed for both watershed protection and flood prevention purposes. Land will be used within its capabilities for treatment and installed in accordance with needs and objectives to be accomplished.

Land treatment measures are the basic element in the watershed project, and were considered as the initial increment for the project formulation. Emphasis will be placed on accelerating those measures which significantly affect sedimentation yields.

A program to meet the land treatment needs has been developed as follows:

Open Land

Vegetative measures will be established to improve soil cover conditions and physical characteristics of the soil. This will decrease runoff and erosion and will assist in preventing sediment from filling stream channels and will result in less deposition on the flood plains. The establishment of diversions, grassed waterways and other needed practices will have a measurable effect in reducing peak discharge by slowing runoff and will augment the soil cover measures in reducing erosion damage and sedimentation yields.

The establishment and development of wildlife practices will improve cover conditions and will contribute to the perpetuation of wildlife in the watershed.

Emphasis will be placed on the treatment of those lands being developed for both private and public recreation use. Intensive treatment of these lands will be necessary where construction measures will temporarily destroy present grass and wooded cover.

Soil surveys have been completed within this watershed and no additional funds will be required for this purpose.

Forest Land

To insure proper forest land treatment and maximum watershed protection, forest landowners will be provided technical assistance for management plans (25), tree planting (130 acres), and hydrologic cultural operations (100 acres). These forestry practices will contribute to improved hydrologic conditions effective in reducing flood peaks and decreasing sedimentation.

Forest trees, through development of deep root systems, extend the soil zone available for storage of water. Forest cover also creates accumulations of litter and humus which protect the soil, increase surface infiltration and percolation rates, and increase soil moisture storage capacity, thereby reducing sedimentation and surface runoff contribution to flood flows.

Manipulation of stand composition through cultural operations creates favorable conditions for the maximum production and protection of litter, humus and forest cover.

Management plans outline practical measures to be applied in the immediate future to maintain and improve forest hydrologic condition. This service, together with other technical assistance to the landowner, insures that watershed values are not impaired.

The soil and water conservation district programs and the technical assistance programs, made available through the districts, emphasize the use of the land within its capabilities. The district programs will be geared to assist landowners in making proper land use adjustments especially on those areas changing from part-time agricultural enterprise to non-agricultural land use.

Structural Measures

Sixty-six percent of the Mauch Chunk Creek drainage area above Jim Thorpe will be controlled by site PA-462.

Site PA-462 is a multiple-purpose flood prevention, water supply, and recreation development dam. It is located on Mauch Chunk Creek approximately one mile west of the junction of Pa. Legislative Route 13033 and Pa. Legislative Route 13043. It will control 5.95 square miles of drainage area. The dam will be 50 feet high and will be composed of 326,671 cubic yards of earth and rock fill. It is designed with a single stage riser and 36-inch pipe combination principal spillway having a maximum release rate of 219 cubic feet per second.

The dam will store 1,094 acre feet of floodwater (the equivalent of 3.45 inches of runoff), 375 acre feet of water supply water, and 3,794 acre feet of recreational development water below the crest of the emergency spillway. The recreation development created by the dam will provide a 330-acre lake. It will have a 250-foot emergency spillway on the left abutment.

The water supply outlet features consist of a 12-inch pipe which will have sufficient capacity for release of water to the filtration plant and for required low flow augmentation.

A transmission line crosses the upper limit of the flood pool. One tower is located at an elevation 1.5 feet below the emergency spillway level (100-year flood frequency).

The associated recreation facilities at PA-462 will be constructed along the northern boundary of the lake. All of the land between the lake and Legislative Route 13033 will be acquired for these facilities. The type and amount of facilities to be installed are shown in Table 2B.

EXPLANATION OF INSTALLATION COSTS

Land Treatment

The unit costs for installation of land treatment measures were based on current costs of materials, equipment and services for similar work.

The cost of technical assistance for the installation of land treatment measures was based upon analysis of expenditures for this type of assistance and soil and water conservation districts' accomplishments for the past several years.

Costs for the installation of forest land treatment measures are based on current costs of supervision, labor, equipment, and materials needed for each measure. Costs of technical assistance are based on actual expenditures and accomplishments of the Pennsylvania Department of Forests and Waters. An analysis of costs against accomplishments was made for each measure to determine unit costs.

Structural Measures

Construction costs for the structural measures were based upon unit prices from recent contracts for comparable work. These estimates were based on a summation of the costs for clearing, grubbing, common excavation, compacted earth fill, drainage material, rock excavation, concrete pipe, seeding and mulching. The total construction cost estimates included 12 percent for contingencies. Installation service costs included estimates for detailed geologic investigations for each site. Other engineering and administrative services were estimated as a percentage of the construction cost based upon records of recent experience for similar work.

Land values in the area affected by the structure were estimated by the sponsors.

Property survey costs to establish boundaries for land acquisition were based upon records of recent experience for similar work.

The estimated costs for administration of contracts and operation and maintenance were based upon records of these costs from similar projects in the state over the last three years.

The costs of the associated recreation facilities to be constructed in conjunction with PA-462 were based upon the costs of similar facilities constructed in the state in the past few years.

The joint costs for structure PA-462 were allocated by the use of facilities method which apportioned 21.7 percent to flood prevention, 71.3 percent to recreation development, and 7.0 percent to water supply.

A 12-inch pipe extending through the dam will provide the outlet for water supply and required low flow augmentation. This item is estimated to cost \$5,000 and has been assigned as a specific cost which will be paid entirely by the sponsors.

Public Law 566 funds will provide all of the flood prevention construction costs, 50 percent of the recreation construction costs, and 50 percent of the costs of associated recreation facilities. They will also provide for all engineering service costs for flood prevention and recreation construction, and 50 percent of the engineering service costs for construction of the recreation facilities.

The sponsors will provide for all of the land rights' costs, 50 percent of the recreation construction costs, 50 percent of the cost of associated recreation facilities, and all of the construction costs allocated to municipal water supply, including specific costs. They will also provide all engineering service costs for water supply and 50 percent of the engineering service costs for construction of the recreation facilities. The following summarizes the construction schedule and the estimated installation costs:

<u>Year</u>		<u>Structural Measures</u>	<u>Land Treatment</u>	<u>Total</u>
1st	P. L. 566	50,000	2,000	52,000
	Other	300,000	10,000	310,000
	Yearly Total	<u>350,000</u>	<u>12,000</u>	<u>362,000</u>
2nd	P. L. 566	150,000	2,000	152,000
	Other	125,000	20,000	145,000
	Yearly Total	<u>275,000</u>	<u>22,000</u>	<u>297,000</u>
3rd	P. L. 566	150,000	3,000	153,000
	Other	125,000	30,000	155,000
	Yearly Total	<u>275,000</u>	<u>33,000</u>	<u>308,000</u>
4th	P. L. 566	84,617	2,450	87,067
	Other	117,230	46,610	163,840
	Yearly Total	<u>201,847</u>	<u>49,060</u>	<u>250,907</u>
Project)	P. L. 566	434,617	9,450	444,067
Period)	Other	667,230	106,610	773,840
Totals)	Yearly Total	<u>1,101,847</u>	<u>116,060</u>	<u>1,217,907</u>

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention

The proposed measures virtually will reduce the 100-year frequency peak flow on Mauch Chunk Creek to the capacity of the channel in Jim Thorpe. That small portion of the 100-year frequency peak flow which may exceed the channel capacity will be deflected into Broad Street at

certain locations. The resultant flow in the stream will be approximately curb deep and will not cause measurable damage.

Damages from the 100-year flood event will be reduced from \$440,000 to zero dollars. Average annual flood damages of \$8,846 will be eliminated. The 204 residences, 37 businesses, 4 industries, and nearly a mile of highway subject to flood damage will be relieved of future flood hazard.

Recreation

The 330-acre permanent lake will greatly increase the water oriented recreation opportunities in the area. The lake will have five miles of shore line. Approximately 75 percent of the lake will be between five to fifteen feet deep, which is the optimum depth for fishery resource management. It will be stocked with warm water fish species including game fish. The 1,600 acres of land to be acquired will not only permit development of recreation facilities immediately surrounding the lake but will assure that land will be available to meet future recreation needs in the area. The additional public land to be acquired will permit development of nature study areas, camping areas, and other facilities.

The lake and associated recreation facilities will be used throughout the year with major use anticipated in the summer season. The peak daily use is estimated to be 4,000 visitor days. Recreation facilities to be installed will permit swimming, boating, fishing, picnicking, nature study, and hiking.

The development plan prepared for the area by the consulting firm of Candeub, Cabot and Associates indicates that the lake will serve as a nucleus for development by private investors of associated facilities. It is estimated that these facilities will cost approximately six million dollars. The service industries created by this development will provide approximately 250 full-time jobs.

The recreation facilities have been planned in accordance with state regulations. Final designs and standards for operation of the facilities will be approved by the appropriate state agencies.

Water Supply

The construction of PA-462 to include 375 acre feet of storage for municipal water supply will provide 120 million gallons of water as a reserve for drought periods and for an anticipated increase in future needs. An assured water supply will assist in the orderly development of the community of Jim Thorpe and will serve to encourage the expansion of present industries and the establishment of new industries in the community.

PROJECT BENEFITS

Total average annual benefits accruing to the structural measures are \$229,125 and to land treatment measures are \$420. The average annual floodwater damage without the project is estimated to be \$8,846. This figure is reduced to zero with the project installed.

Average annual flood prevention benefits accruing to the structural measures are \$8,425.

As indicated in Table 5, flood prevention benefits are 49 percent commercial, 34 percent residential, 8 percent industrial, with the remaining 9 percent accruing to utilities.

Average annual benefits of \$7,000 were assigned to municipal water supply. The benefits for the water supply were arrived at by the consultant retained by the Borough of Jim Thorpe.

Annual benefits of \$180,000 were assigned to the recreation development at site PA-462. Facilities at this site were designed to permit 120,000 recreation days of use annually at a benefit of \$1.50 per user day.

Additional benefits to fish and wildlife will result from increasing their habitat, increasing productivity of existing habitat, and making it available for public use. Land treatment measures planned will also improve wildlife habitat by improving food and cover conditions. These benefits were not included in the evaluation.

The proposed forest land treatment measures will improve the hydrologic conditions of the forest land. This will reduce sediment and retard runoff. Good management and continued fire protection will increase the productivity of the forest land.

Carbon and Schuylkill Counties have been assigned as Section 5A counties under the Area Redevelopment Act. Benefits resulting from increased labor resources required for project construction and operation and maintenance have been assigned. In addition benefits resulting from added area employment resulting from opportunities created by the project were also assigned. The evaluation of these benefits was limited to the first 20-year period of the project. The redevelopment benefits stemming from increased labor use are \$5,300. Because of chronic unemployment of labor resources in the area, added unit of employment is significant.

Secondary benefits were evaluated in monetary terms and included in the economic justification of the project. The value of local secondary benefits stemming from and induced by the project, \$28,400, was considered to be equal to 10 percent of the direct primary benefits. They included the proposed expansion of residential development in the areas adjacent to the recreation development and the establishment of private service industries in conjunction with the recreation

development. Secondary benefits from the national viewpoint were not considered pertinent to the economic evaluation.

Non-monetary benefits will also accrue from the knowledge that businesses and homes are protected from flood loss and the peace of mind this affords. This fact will increase the spirit and effectiveness of all activities in the watershed.

COMPARISON OF BENEFITS AND COSTS

The structural measures described in this work plan are economically justified.

The ratio of the average annual structural benefits (\$200,725) without the inclusion of local secondary benefits, to the estimated average annual costs (\$55,240) is 3.8 to 1.0.

The total average annual benefits, including local secondary benefits of \$28,400 are \$229,125. The benefit cost ratio is 4.1 to 1.0. Table 6 shows a comparison of annual costs to annual benefits.

PROJECT INSTALLATION

The installation period for accomplishing the plan will be four years.

The Carbon and Schuylkill County Soil and Water Conservation Districts will be responsible for working with landowners and operators to carry out the land treatment measures to be established within the next four years. The Soil and Water Conservation Districts, with the assistance of the Soil Conservation Service, will assist landowners and operators cooperating with the district in the preparation and application of conservation plans.

Fifty percent of the farmland in the drainage area above the multiple purpose structure will be under cooperative agreement with the Soil and Water Conservation Districts before construction of the dam can be initiated. Technical assistance to district cooperators will be accelerated under the Public Law 566 program as set forth in this work plan. Provisions for carrying out this accelerated program will be included in the annual work plans of the Soil and Water Conservation Districts.

The forest land treatment measures will be installed by the landowners and operators with technical assistance furnished by the Pennsylvania Department of Forests and Waters in cooperation with the U. S. Forest Service.

The Soil and Water Conservation Districts have agreed that an intensive program of assisting landowners in the drainage area above PA-462 has the highest priority. Provisions for carrying out this accelerated program will be included in the annual work plans of the Soil and Water Conservation Districts. The annual work plans will also include goals for the establishment of land treatment practices.

Land use adjustments and other conservation activities set forth in the work plan will be met within the program period.

The Agricultural Extension Service of the Pennsylvania State University, through the County Agricultural Extension Agents, will assist the Soil and Water Conservation Districts in developing and carrying out an information and education program to stimulate interest in watershed activities.

The local political sub-divisions in the Mauch Chunk Creek watershed have indicated they will develop appropriate land use plans and zoning ordinances in order to insure that the developments surrounding the public land are fully compatible with the project as outlined in this plan.

The Pennsylvania Fish Commission will be responsible for purchasing 700 acres of land which will include that land within the top of dam elevation, sufficient land for construction of the dam and outlet works, and an area surrounding the dam to permit appropriate development and full use of fishing and boating facilities. The Carbon County Recreation Authority and the Carbon County Commissioners will acquire an additional 900 acres of land within the general boundaries set forth in the Recreational Development Map. The above sponsors will pay all costs for land, and for surveys, legal fees or other costs incident to the acquiring of land rights.

The Carbon County Recreation Authority and the Carbon County Commissioners will be responsible for the recreation construction costs and the engineering services and construction costs for the associated recreation facilities. The Pennsylvania Department of Forests and Waters and/or the Water and Power Resources Board of the Department will cooperate with the Carbon County Commissioners in sharing a portion of the local costs. It is estimated that the Commonwealth will provide approximately \$100,000 as its share of the construction costs of Structure PA-462. The Boroughs of Jim Thorpe and Summit Hill will provide \$20,000 as part of the costs of recreation construction. The Carbon County Commissioners are responsible for providing the remainder of the local costs relative to recreation construction and associated recreation facilities.

The Carbon County Commissioners will be responsible for administration of contracts for construction of PA-462 and the associated recreation facilities.

The Borough of Jim Thorpe will be responsible for construction and engineering service costs of the municipal water supply features of PA-462.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement on non-Federal land as described in this work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act, Public Law 566, (83d Congress, 68 Stat. 666), as amended.

The Soil and Water Conservation Loan Program of the Farmers Home Administration is available to all eligible farmers in the watershed.

The Carbon and Schuylkill County Agricultural Stabilization and Conservation Committees, in administering the Agricultural Conservation Program, will assist in the land treatment program through cost sharing. The actual determination of how much assistance can be provided will be made on an annual basis and will be influenced by the needs and desires of the landowners. The Soil and Water Conservation Districts, the County Agricultural Stabilization and Conservation Committees, the Pennsylvania Department of Forests and Waters, the U. S. Forest Service, and the Soil Conservation Service will, on an annual basis, determine how each can best contribute in carrying out an accelerated land treatment program in the watershed.

The total cost of installing forest land treatment measures is estimated to be \$16,600. Technical assistance to forest landowners for the installation of these measures will amount to \$7,400 of which \$4,100 will be provided through the Public Law 566 program and \$3,300 by the Pennsylvania Department of Forests and Waters. The remaining \$9,200 is an installation cost and includes \$2,000 to be contributed by the Pennsylvania Department of Forests and Waters toward the cost of tree seedlings furnished to landowners.

The Pennsylvania Fish Commission will provide funds for carrying out its responsibilities from its allocation of Project 70 funds.

The Pennsylvania Department of Forests and Waters will provide funds for carrying out its responsibilities from its general appropriation. The Boroughs of Summit Hill and Jim Thorpe will provide funds for carrying out their responsibilities from their tax general funds.

The Carbon County Commissioners and the Carbon County Recreation Authority will provide funds for carrying out their responsibilities from Project 70 funds, an Open Space Grant from the Home and Housing Finance Administration of the U. S. Department of Health, Education and Welfare, general funds or taxation.

The Carbon County Recreation Authority has made application for Project 70 funds from the State of Pennsylvania and for an Open Space Grant from the Home and Housing Finance Administration to assist in the acquisition of land. The State of Pennsylvania has granted a preliminary allocation of \$82,750 from Project 70 funds to the Carbon County Recreation Authority for this acquisition. The Home and Housing Finance Administration has indicated, conditional upon acceptance of a qualified plan, that the Carbon County Recreation Authority is eligible

for a maximum of 30 percent Open Space funds for the cost of acquiring this land.

Financial and other assistance to be provided by the Pennsylvania Fish Commission and the Pennsylvania Department of Forests and Waters in carrying out their responsibilities as set forth in the watershed work plan is contingent on the availability of funds for this purpose.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment

Land treatment measures for both open land and forest land will be maintained by the landowners or operators of the land on which these measures are installed. Maintenance and treatment measures will be promoted and encouraged through the Soil and Water Conservation Districts' program with technical assistance furnished by the Soil Conservation Service and other Federal, State and local organizations.

The forest land treatment measures will be operated and maintained by the landowners with technical assistance provided by the Pennsylvania Department of Forests and Waters in cooperation with the U. S. Forest Service under the going Cooperative Forest Management Program. Other Federal-State cooperative forestry programs will continue after the installation period.

Structural Measures

Land treatment measures will be maintained by the landowners and operators under agreement with the Carbon and Schuylkill County Soil and Water Conservation Districts.

The Carbon County Recreation Authority and the Carbon County Commissioners will maintain the areas as a public park and will provide necessary custodial, policing, sanitation, safety and other operational features. Costs for periodic replacement of the recreation facilities have been developed. The estimated \$19,145 annual operation and maintenance costs include wages for seasonal labor, costs of maintenance equipment and costs of repair and replacement of the basic recreation facilities.

The Carbon County Recreation Authority, acting in behalf of the Carbon County Commissioners, has indicated that it will charge a fee limited to the use of the parking facilities at the recreation development. The income from this fee will be limited to that amount of money required to provide for operation and maintenance costs.

All structural measures should be inspected after every major storm and will be inspected at least once a year. Representatives of the sponsoring local organizations responsible for operation and maintenance and the Soil Conservation Service will jointly make the required annual inspection. A report including recommendations for repairs, improvements and replacements will be prepared and filed for

each inspection. A report will also be prepared for the completed maintenance.

The structural works of improvement will be operated in such a manner that they will serve the purpose, both as to function and time, for which they are installed.

The maintenance will consist of, but not be limited to, the following:

1. Remove and burn debris.
2. Refill, smooth and vegetate rilling on embankments, spillways, and drainageways.
3. Realign disposal channels.
4. Repair damaged riprap, concrete or other works.
5. Repair fences and gates.
6. Maintain good sod covers.

Jim Thorpe Borough will be responsible for the removal of logs, brush, and other trash and debris from the Mauch Chunk Creek below the retarding structure. All parties recognize that the operation of the channel within Jim Thorpe during a flood is very sensitive to trash and debris accumulations.

Specific maintenance agreements will be entered into prior to the execution of the project agreement for works of improvement.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Mauch Chunk Creek Watershed, Pennsylvania

Installation Cost Item	Unit	To be Applied	Estimated Cost ^{1/}		
		Non-Federal Land	P.L. 566 Dollars	Other Dollars	Total Dollars
<u>Land Treatment</u>					
Soil Conservation Service					
Cropland	acre	200	-	11,910	11,910
Grassland	acre	500	-	80,570	80,570
Technical Assistance			5,350	1,630	6,980
SCS Subtotal			5,350	94,110	99,460
Forest Service					
Woodland	acre	230	-	9,200	9,200
Technical Assistance			4,100	3,300	7,400
FS Subtotal			4,100	12,500	16,600
TOTAL LAND TREATMENT			9,450	106,610	116,060
<u>Structural Measures</u>					
Multiple Purpose Structure	each	1	278,689	212,255	490,944
Basic Recreation Facility	each	1	77,350	77,350	154,700
Subtotal - Construction			356,039	289,605	645,644
<u>Installation Services</u>					
Engineering Services			59,322	16,225	75,547
Other			19,256	-	19,256
Subtotal - Installation Services			78,578	16,225	94,803
<u>Other Costs</u>					
Land, Easements & R/W			-	355,400	355,400
Administration of Contracts			-	6,000	6,000
Subtotal - Other Costs			-	361,400	361,400
TOTAL STRUCTURAL MEASURES			434,617	667,230	1,101,847
TOTAL PROJECT			444,067	773,840	1,217,907
<u>SUMMARY</u>					
Subtotal - SCS			439,967	761,340	1,201,307
Subtotal - FS			4,100	12,500	16,600
TOTAL PROJECT			444,067	773,840	1,217,907

^{1/} Price Base - 1964.

April 1965

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

Mauch Chunk Creek Watershed, Pennsylvania

Measures	Unit	Applied To Date	Total Cost (Dollars) <u>1/</u>
<u>LAND TREATMENT</u>			
Conservation Cropping System	acre	70	2,100
Diversion	feet	4,860	1,460
Contour Farming	acre	50	150
Grasses & Legumes in Rotation	acre	70	3,500
Wildlife Habitat Development	acre	10	300
Tree Planting	acre	20	1,200
Hydrologic Cultural Operations	acre	200	<u>7,000</u>
TOTAL LAND TREATMENT			15,710

Structural Measures
None Applied

1/ Price Base - 1964

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Mauch Chunk Creek Watershed, Pennsylvania

(Dollars) 1/

Structure Site No.	Installation Cost - P.L. 566 Funds				Installation Cost - Other Funds				Total Inst. Cost
	Construction	Instal. Services		Total P. L. 566	Construction	Instal- lation Services	Other		
		Engineering	Other				Adm. Of Contracts	Easements & R/W	
PA-462									
Joint Cost	278,689	51,294	16,134	346,117	207,255	5,075	5,000	114,000	331,330
Specific Cost					5,000 <u>2/</u>				5,000
Basic Recreation Facilities	77,350	8,028	3,122	88,500	77,350	11,150	1,000	241,400	330,900
GRAND TOTAL	356,039	59,322	19,256	434,617	289,605	16,225	6,000	355,400 <u>2/</u>	667,230
									1,101,847

1/ Price Base - 1964

2/ Includes \$35,400 for land rights' survey and legal cost.

3/ For water supply facilities.

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TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Mauch Chunk Creek Watershed, Pennsylvania

(Dollars) 1/

Item	Purpose			Total
	Flood Prevention	Recreation	Water Supply	

COST ALLOCATION

Multiple Purpose

PA-462	122,486	924,590	54,771	1,101,847
<u>TOTAL</u>	<u>122,486</u>	<u>924,590</u>	<u>54,771</u>	<u>1,101,847</u>

COST SHARING

P. L. 566	121,184	313,433	-	434,617
Other	1,302	511,157	54,771	667,230
<u>TOTAL</u>	<u>122,486</u>	<u>924,590</u>	<u>54,771</u>	<u>1,101,847</u>

1/ Price Base - 1964

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TABLE 2B - ESTIMATED CONSTRUCTION COST OF RECREATIONAL FACILITIES

Mauch Chunk Creek Watershed, Pennsylvania

(Dollars) ^{1/}

Facility	Number	Unit Cost	Total Construction Cost
Picnic Unit (4 tables, fire rings, site preparation)	40 Units	400	16,000
Swimming Beach	71,500 Sq.Ft.	25¢/Sq.Ft.	17,880
Parking (Stabilized area and guard rails)	400 Spaces	100	40,000
Boating (Ramps, docks, site preparation)	300 Spaces	50	15,000
Sanitary Facilities	36 Units	500	18,000
Water System	13 Units	1,000	13,000
Roads	2 Miles	15,000	30,000
Trails	.5 Miles	2,640	1,320
Signs & Markers	-	-	500
Landscaping	-	-	3,000
TOTAL			154,700

^{1/} Price Base - 1964April 1965

TABLE 3 - STRUCTURAL DATA
FLOODWATER RETARDING STRUCTURES AND WATER SUPPLY RESERVOIRS

Mauch Chunk Watershed, Pennsylvania

ITEM	Unit	PA-462
Drainage Area	sq.mi.	5.95
Storage Capacity		
Sediment	ac.ft.	61
Recreation Development	ac.ft.	379 $\frac{1}{4}$
Water Supply	ac.ft.	375
Floodwater	ac.ft.	109 $\frac{1}{4}$
Total	ac.ft.	532 $\frac{1}{4}$
Surface Area		
Sediment Pool	acres	--
Recreation Development	acres	330
Water Supply	acres	350
Floodwater Pool	acres	38 $\frac{1}{4}$
Volume of Fill	cu.yd.	326,671
Elevation, Top of Dam	feet	1019.3
Maximum Height of Dam	feet	50
Emergency Spillway		
Crest Elevation	feet	1013.0
Bottom Width	feet	250
Type		sod
Percent Chance of Use		1.0
Ave. C.C. Curve No. (Cond.II)		77
Emergency Spillway Hydrograph		
Storm Rainfall (6-hr.)	inch	12.2
Storm Runoff	inch	11.22
Velocity of Flow (Vc)	ft./sec.	6.9
Discharge Rate	c.f.s.	3375.0
Max. Water Surface Elevation	feet	1016.3
Freeboard Hydrograph		
Storm Rainfall (6-hr.)	inch	25
Storm Runoff	inch	21.7 $\frac{1}{4}$
Velocity of Flow (Vc)	ft./sec.	10.6
Discharge Rate	c.f.s.	10,250
Max. Water Surface Elevation	feet	1019.3
Principal Spillway		
Capacity - High Stage	c.f.s.	219
Capacity Equivalents		
Sediment Volume	inch	0.202
Detention Volume	inch	3.45
Spillway Storage	inch	8.29
Class of Structure		C

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TABLE 4 - ANNUAL COST
Mauch Chunk Creek Watershed, Pennsylvania

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost <u>2/</u>	Operation and Maintenance Cost <u>3/</u>	Total
PA-462	36,095	19,145	55,240
Total	36,095	19,145 <u>4/</u>	55,240

1/ Price Base - 1964

2/ Amortized 3 1/8 percent for 100-year period (.03276).

3/ O&M - Long term price level as projected by Agricultural Research Service, Price Projection, September 1957.

4/ Includes \$18,445 annual costs for recreational facilities.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Mauch Chunk Creek Watershed, Pennsylvania

(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Non-Agricultural			
Commercial	3,636	-	3,636
Residential	2,511	-	2,511
Industrial	575	-	575
Road & Bridge	650	-	650
Subtotal	7,372	-	7,372
Indirect	1,474	-	1,474
Total	8,846	-	8,846

1/ Price Base - Long term prices as projected using Commerce Composite Construction Index, Agricultural Research Service, September 1957 price projection.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Mauch Chunk Creek Watershed, Pennsylvania

(Dollars) ^{1/}

Evaluation Unit	Average Annual Benefits				Average Annual Cost	Benefit Cost Ratio
	Flood Prevention Damage Reduction	Municipal Water Supply	Other	Total		
PA-462	8,425	7,000	213,700	229,125	55,240 ^{2/}	4.1 to 1.0
GRAND TOTAL	8,425 ^{3/}	7,000	213,700 ^{4/}	229,125	55,240	4.1 to 1.0

^{1/} Price Base - 1964 - Long term price level as projected by Agricultural Research Service, Price Projection, September 1957.

^{2/} Includes \$18,445 annual cost for recreational facilities.

^{3/} In addition it is estimated that land treatment measures will provide flood damage reduction benefits of \$420 annually.

^{4/} Other includes:

Recreation Benefits \$ 180,000
 Redevelopment Benefits 5,300
 Secondary Benefits 28,400

GLOSSARY OF TERMS

<u>Average Annual Cost</u>	Total installation cost amortized over a 100-year period at 3 1/8 percent interest plus annual operations and maintenance costs.
<u>Average Annual Damage</u>	The summation of all expected flood damage in 100 years divided by 100.
<u>Easements and Rights-of-Way Cost</u>	Cost to acquire land or obtain easements on land, relocate or alter existing roads, utilities, etc., necessary for the installation of the structure.
<u>Floodwater Retarding Structure</u>	A dam built to contain excess runoff water and regulate its release.
<u>Flood Detention Pool</u>	A volume of space incorporated in a reservoir to store excess runoff water.
<u>Floodwater Damage</u>	Direct accountable damage to property caused by flooding.
<u>Flood Prevention Benefits</u>	Reduction of floodwater and sediment damages expressed in monetary terms.
<u>Frequency of Flooding</u>	An estimate of how often various flood magnitudes will occur. <u>Example:</u> 50-year frequency -- once in 50 years or twice in 100 years.
<u>Indirect Damage</u>	Non-enumerated damage related to flooding. <u>Example:</u> Detours caused by road or bridge washout, loss of wages caused by inability to travel to job, spoilage of food caused by electric utility failure, etc.
<u>Key Flood</u>	A flood about which much information is available. Stage damage relationships are keyed to the stage of this flood.
<u>Other Costs</u>	Costs other than Public Law 566 costs.
<u>P. L. 566 Costs</u>	Costs which the Federal Government is authorized to bear under authority of Public Law 566.

INVESTIGATIONS AND ANALYSES

Hydrologic

Discharge frequency relationships were obtained by routing various frequency rainstorms through the Jim Thorpe flood damage. Rainfall frequency information was obtained from U. S. Weather Bureau Technical Paper 40. Runoff rates were determined according to the weighted soil cover complex numbers which were computed using table 3.9-1 of the National Engineering Handbook, Hydrology, Section 4. A tabulation of the soil type and hydrologic characteristics were supplied by the work unit conservationist.

The Forest Service supplied the hydrologic data on forest land and the forest land complex numbers. Information was collected in a series of field plots, selected systematically, where measurements of litter, humus, soil type and other hydrologic factors were recorded and analyzed.

The watershed was divided into three sub-watersheds to analyze separately the areas above site PA-462, below PA-462 to the edge of town, and the watershed area in Jim Thorpe itself. Simple hydrographs for each sub-watershed were prepared using the formulae:

$$\text{Peak discharge} = \frac{484 \text{ AQ}}{T_p};$$

$$T_p = \frac{D}{2} + .6T_c; \quad T_b = 2.67T_p$$

Q, the runoff in inches and D, the storm duration in hours are the storm variables.

These hydrographs were then routed through the damage centers using the Wilson method, thus setting up discharge versus frequency curves.

An actual storm which occurred on August 24, 1933 was used to verify routing procedures and stage discharge curves at several points in Jim Thorpe. Hourly rainfall data was available from the Mauch Chunk rain gage which is located on the edge of the watershed.

This key flood was caused by a 4.31 inch rainstorm of 12 hours duration following less than one day after a 2.7 inch downpour. The damage versus stage relationships were based on this storm because of the availability of many high water marks.

Two discharge frequency curves were prepared--one at the upper edge of Jim Thorpe, and the second for the downtown reach. Three stage versus discharge curves were prepared, one in the upper reach (A) of town and two in the downtown reaches (B and C). Culvert formula for the underground conduit plus open channel formula for out-of-bank flow in Broadway Avenue were used to determine stage versus discharge curves.

Low bank capacities in each damage reach were carefully computed because of the desirability of a large principal spillway release rate from PA-462. Almost the maximum permissible release rate was designed into the dam in order to keep the flood storage requirement, and costs, to a minimum.

Storage requirements were determined by the procedure outlined in Soil Conservation Service Technical Release 10. The 100-year frequency precipitation used in this procedure was obtained from U. S. Weather Bureau Technical Paper 40.

Emergency spillway design was based on a precipitation 25 percent greater than ES-1020 for class C structures. This amounted to 12.2 inches of rain which was converted to runoff based on a saturated antecedent soil moisture condition.

The freeboard design was based on the maximum probable six-hour storm for class C structures. This amounted to 25 inches of precipitation which was converted to runoff based on an average antecedent soil moisture content.

Engineering

PA-462 was selected on the basis of a study of U. S. Geologic Survey topographic maps, a field study of specific site conditions and a study of the estimated federal and local costs.

The procedure used for the preliminary design was as follows:

1. A plane table survey was made of the site having a scale of one inch equals 200 feet and a 10-foot contour interval.
2. Stage-area and stage-storage curves were developed from this map.
3. Using the stage-storage curve the crest of the principal spillway was set at an elevation equal to the sum of the sediment, water supply, and recreational storage requirements.
4. The floodwater detention and principal spillway requirements were determined by the hydrologist.
5. The elevation of the crest of the emergency spillway was determined by adding the storage computed in step 3 to the storage necessary in step 4.
6. The bottom width of the emergency spillway was chosen on the basis of (1) permissible velocity of flow through the spillway, (2) minimum rock excavation, (3) utilization of the excavated material in the embankment, and (4) minimum total cost of the project.

The emergency spillway hydrograph was routed through the structure using emergency spillways of various widths, by the parabolic method described in Technical Release #2, Design Section. From these trial routings and consideration of the items listed above, the emergency spillway dimensions were determined.

7. The top of dam elevation was determined by flood routing the freeboard hydrograph through the structure by Method 2 described in Section 5.8, National Engineering Handbook, Hydraulics.
8. Preliminary design quantities used for estimating the construction costs were determined for the following items: clearing, clear and grub, fill (earth and rock), excavation (common and rock), pipe, concrete, filter and drainage materials, rock riprap, fencing, and seeding.

PA-462 is designed with a two-to-one downstream slope and a three-to-one upstream slope. It will have a 250 foot emergency spillway cut into the left abutment. A combination of a cutoff trench and a toe drain will control seepage and uplift pressures.

PA-462 has been classified as a "C" structure according to Engineering Memorandum, SCS-27.

Preliminary design criteria is subject to change based on detailed geology and soil mechanics information which will be obtained prior to final design.

Geology

A reconnaissance was made of land subject to flooding for damages caused by streambank erosion, swamping, flood plain scour and infertile overwash. Damages from these sources occurred to residential areas, roads, woodland and non-agricultural land.

Sediment damage to homes and businesses was included with flood-water damage due to the difficulty in separating the two.

The sediment storage requirement for the proposed floodwater retarding structure was computed by procedures outlined in the Geology Section of the Watershed Planning Guide. Factors taken into consideration are sheet erosion, channel erosion, delivery rate to the structure and the trap efficiency of the reservoir. Sheet erosion was computed from Musgrave's Soil Loss Formula using basic data taken from county soil maps and field measurements. Sediment storage will contain the expected sediment accumulation at the reservoir for a one hundred-year period.

A preliminary geologic site investigation was made on the proposed dam site in order to determine the subsurface conditions and the engineering characteristic of the materials at the site.

The field procedures used in the preliminary geologic investigation of the site included the use of a portable refraction seismograph, manual sampling and exploration tools, and soil testing equipment. Data obtained from the field and laboratory were plotted on maps, cross sections, and profiles, and correlation was effected. Features such as bedrock profiles, soil types, and ground water levels were plotted and their relationship with the proposed work of improvement was shown. Natural and other existing exposures were utilized where possible.

The preliminary geologic investigation revealed a relatively steep sided mountain valley site formed from red shales and sandstones of the Mauch Chunk shale formation of the Mississippian period. These strata strike approximately N 70 E and dip to the north at a moderate angle. This basal rock foundation is overlain on the left abutment by 30 to 40 feet of glacial drift of the Illinoian glacial stage grading from a sandy silt or clay to a silty sand. The flood plain consists of the same type of glacial drift overlain by 6 to 10 feet of alluvium varying from silty sands to organic silts. In the right abutment a glacial material strata is overlain by rubble of gray conglomerate boulders up to two cubic yards in size. These are held in a silty sand matrix. Springs occur at the base of both abutments.

The emergency spillway is planned for the left abutment and the excavated material will be used in the embankment. Borrow from the emergency spillway excavation will be a sandy silt (ML) soil with associated gravels and cobbles. Further borrow for the structure will be taken from a borrow pit located immediately upstream from the emergency spillway excavation.

Sediment storage for the structure is 61.0 acre feet with 51 acre feet in the permanent pool and the remainder in the flood pool.

A geologic report including description, interpretations and conclusions was written for the site. A plan and cost estimate for the detailed geologic investigation of the site has been made.

Economics

The basic information on damages was obtained in the field from personal interviews with property owners and was recorded on flood damage schedules. This information was related to the flood of August 24, 1933. The sponsoring organizations cooperated in contacting all of the owners or operators of commercial and industrial property and approximately 40 percent of the residential property owners that were affected by Mauch Chunk Creek. Damages for stages above and below the 1933 flood level were appraised in one-foot increments.

The damage estimates were tabulated by stages and converted to long-term prices using Agricultural Research Service Price and Cost Projections, September 1957.

All costs to be incurred during the four-year installation period of the project were based on the 1964 price level. Operation and maintenance costs have been adjusted to long-term values.

Floodwater damages and benefits were computed using the frequency method as described in Chapter 3, page 2 of the Economic Guide, Soil Conservation Service. Separate damage-frequency analyses were developed for each reach using the stage-frequency data provided by the hydrologic study. Damage and benefits affecting residential, commercial, and industrial property were computed under (1) condition without the project, (2) conditions after the installation of the proposed land treatment, and (3) conditions with all measures installed.

Since the structural program includes only one dam, one evaluation unit was used. This evaluation study includes all floods up to the 100-year frequency.

A private consultant, Wiesenberger Associates, Inc., was retained by the Borough of Jim Thorpe to make the studies needed in connection with the water supply features of the program. This study indicated the amount of water that should be incorporated in the program to meet the Borough's needs, the benefits that could be attributed to the water supply feature of the plan, and included the specific items to be planned in the structure for the water supply purpose.

A major part of the recreation study was made by the Planning Consultant Firm of Candeub, Cabot and Associates. This firm developed the demand figures for the study area in addition to a general development plan which included intensive use of the watershed for recreation including - skiing, golfing, and other related sports activities. The recreation facilities being planned in connection with PA-462 meet only a portion of this demand. Other water oriented facilities in use or being planned in the county will also help to meet this demand.

Land Treatment

The land treatment program was developed by the Soil and Water Conservation Districts, the Soil Conservation Service, the U. S. Forest Service, the Pennsylvania Department of Forests and Waters, and the Agricultural Stabilization and Conservation Committee.

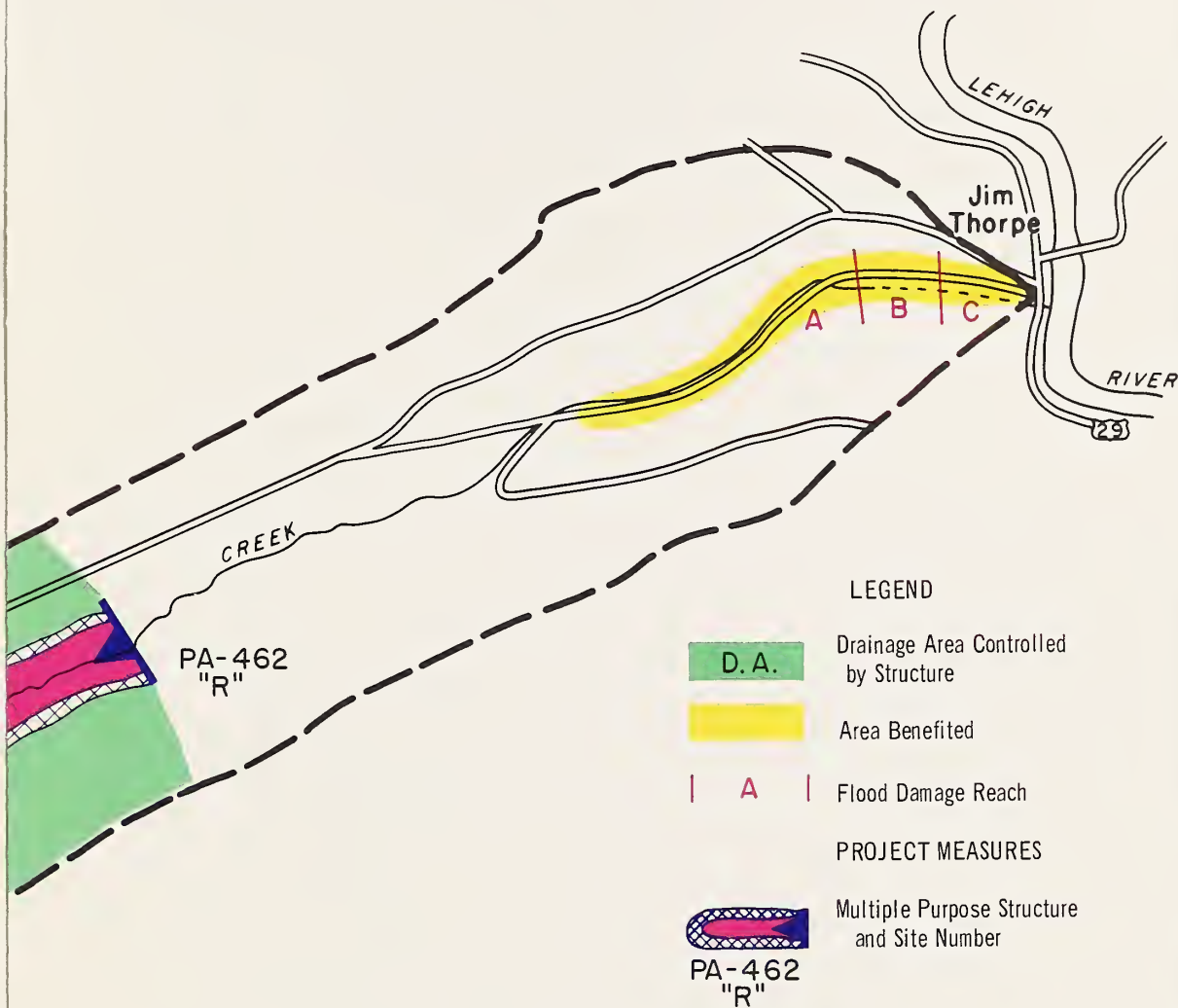
Basic data used in developing the land treatment program included records of conservation treatment by landowners in the watershed, land use trends as indicated by the Conservation Needs Inventory, and census reports. Records of the Soil and Water Conservation District and Agricultural Conservation Program Service were also made available for the study.

The following table indicates present land use and estimates future land use (1975) with the program installed:

<u>Land Use Groups</u>	<u>Present Land Use Acres</u>	<u>Future Land Use Acres</u>
Cropland	230	0
Grassland	60	60
Wildlife-Recreation	235 *	2100 **
Forest	4500	2710
Idle	295	50
Other	<u>470</u>	<u>870</u>
Total	5790	5790

* This acreage is wooded.

** Thirteen hundred acres of this acreage is wooded.

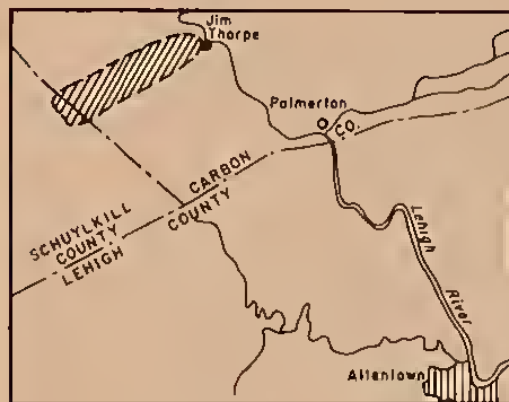


PROJECT MAP MAUCH CHUNK CREEK WATERSHED PENNSYLVANIA

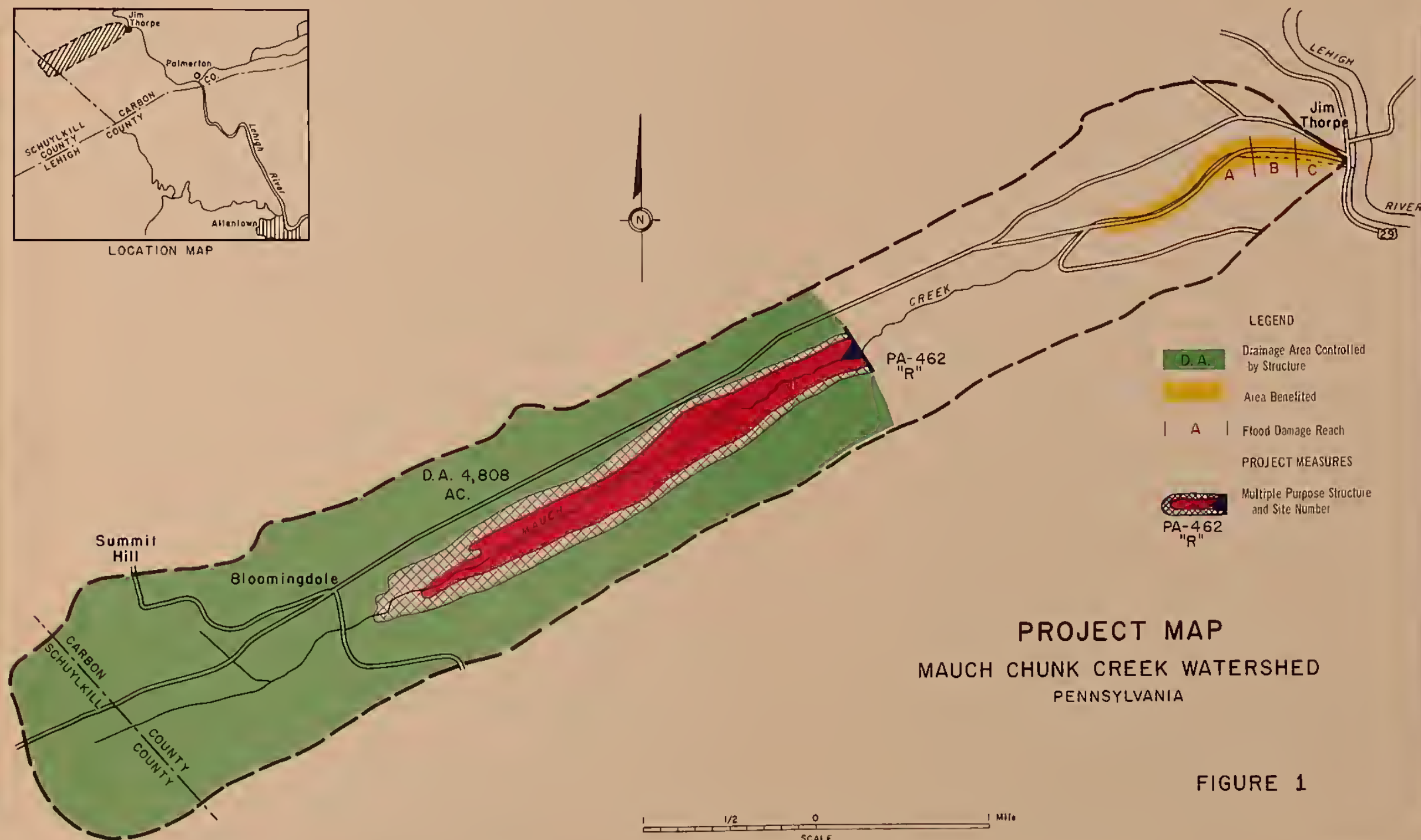
FIGURE 1

0 1 Mile

SCALE

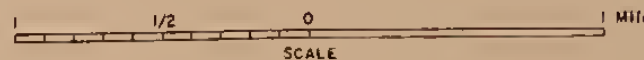


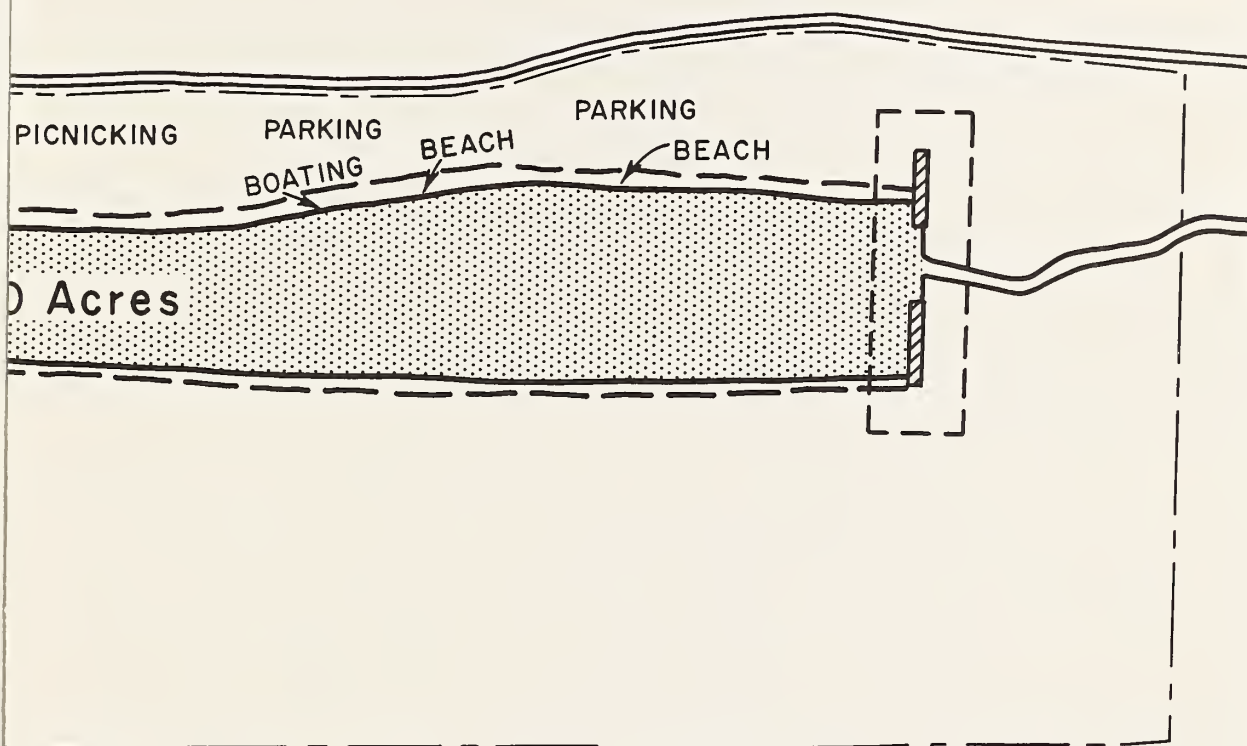
LOCATION MAP



PROJECT MAP MAUCH CHUNK CREEK WATERSHED PENNSYLVANIA

FIGURE 1





RECREATION DEVELOPMENT
MAUCH CHUNK CREEK WATERSHED
SITE PA-462
Carbon County, Pennsylvania

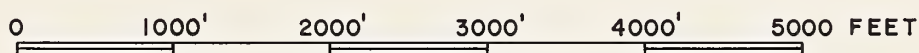
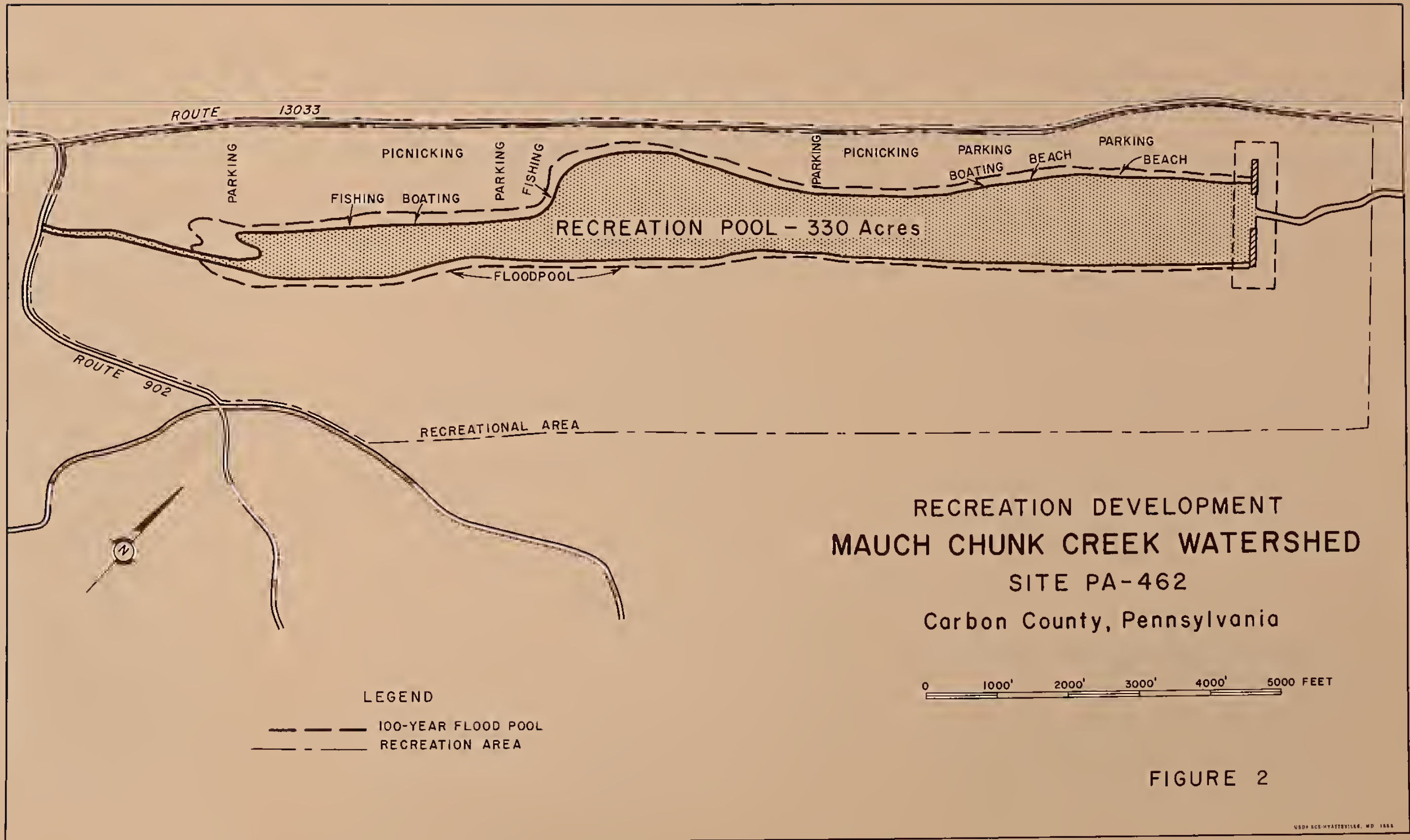


FIGURE 2



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